Exemption No. 5991

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of **DASSAULT AVIATION** for an exemption from § 25.562(c) of the Federal Aviation Regulations	**Regulatory Docket No. 27850**

PARTIAL GRANT OF EXEMPTION

By letter JS/CCh-DGQT/NAV No. 360/94 dated July 18, 1994, Messrs. J. Schmitt, Airworthiness Department, and P.L. Cambefort, Vice President Engineering, Merignac Engineering Division, Dassault Aviation, B.P. 24, 33701 Merignac Cedex, France, petitioned for a temporary exemption from the requirements of § 25.562(c) for side-facing sofas in the Falcon Model 2000 airplane.

Sections of the FAR affected:

Section 25.562(c), as amended by Amendment 25-64, contains in paragraphs (c)(1) through (c)(6) occupant protection pass/fail criteria associated with the dynamic testing of seats required by § 25.562(b). Paragraphs (c)(7) and (c)(8) contain the seat strength pass/fail criteria associated with those same tests.

Related Sections of the FAR

Section 25.562(a), as amended by Amendment 25-64, requires, in pertinent part, that seats and restraints must be designed to protect occupants from the dynamic conditions described in this section.

Section 25.562(b), as amended by Amendment 25-64, describes the dynamic tests that are required to be successfully accomplished for all seats intended to be occupied for takeoff and landing.

The petitioner's supportive information is as follows:

"In accordance with the provisions of 14 CFR 11.25**,** Dassault Aviation respectfully requests an exemption to the requirements of 14 CFR 25.562(c) for side-facing sofas for the new model FALCON 2000 airplane presently undergoing development and certification.

"1.- THE AIRPLANE

The FALCON 2000 airplane is a twin-jet, swept-wing executive transport with a maximum takeoff weight of 36,500 pounds and landing weight of 33,000 pounds.

The VMO is variable from 350 to 370 knots and the MMO is variable from Mach 0.87 up to flight level 380, decreasing to Mach 0.85 at flight level 420 and above. It is powered by two CFE 738 turbofan engines with a maximum sea level takeoff thrust of 5,725 pounds....

"2.- THE CERTIFICATION BASIS

The U.S. certification basis is Part 25 of the Federal Aviation Regulations effective February 1, 1965, as amended by Amendment 25-1 through Amendment 25-69. In addition, Dassault Aviation has elected to comply with § 25.729, as amended by Amendment 25-75; § 25.811(e), as amended by Amendment 25-79; and § 25.1316 as added by Amendment 25-80; Special Conditions to be issued in accordance with § 21.16 of the FAR; Part 34 of the FAR, effective September 10, 1990, plus any amendment which will be applicable on the date the type certificate is issued (Fuel Venting and exhaust emissions); Part 36 of the FAR, effective December 1, 1969, and any subsequent amendments which will be applicable on the date the type certificate is issued; plus [the noise certification requirements of Part 36]. In addition, certification to the Joint Requirement of the Joint Airworthiness Authorities in accordance with the provisions of JAR 25 including change 13 and Special Conditions under preparation has been requested. JAA Type Certification is scheduled for the end of November 1994.

"3.- THE CABIN AND THE NEED OF SOFAS

The FALCON 2000 passenger cabin will be type certified for the carriage of up to 19 passengers. However, the vast majority of custom interiors to be delivered will accommodate 8 to 12 passengers as on the previous model FALCON 900.

The aircraft will be most often utilized for executive air transportation under Parts 91 or 135 of the Federal Aviation Regulations. Due to the nature of the transportation involved, all customers request at least one side-facing sofa, like the previous FALCON

models and other competitors. Moreover, private business meetings are held in flight, and there is an increasing demand for two side-facing sofas....

"4.- THE TECHNICAL PROBLEMS

High level technical discussions have been held with the specialists of the Transport Airplane Directorate of Seattle, as indicated in Issue Paper C-1, Issue 1, dated July 21, 1993, as appended. Since the sofas are intended to be occupied for taxi, takeoff, and landing, they must be shown to comply with the requirements of §§ 25.561 and 25.562 for not only structural integrity, but also occupant protection. The occupant protection pass/fail criteria for dynamic testing contained in § 25.562(c) are more appropriate for forward- or aft-facing seats than for side-facing seats.

Criteria more suitable for side-facing occupants need to be established and applied for this type of seat, so that occupants of a side-facing sofa are provided a level of protection equivalent to that provided occupants for forward- or aft-facing seats.

The areas of concern are the following:

-Contact between adjacent occupants. If the seat and the restraint design do not obviate contact, the consequences of head, torso, and upper and lower limb contact must be shown to be acceptable.

-Retention of the occupant in the seat and restraint system. Failure to restrain the lower limbs may result in undesirable repositioning of the restraint system, e.g., the lap belt riding up to the soft stomach area, a shoulder harness pressing against the neck, or undesirable twisting of the lower lumbar spinal column. A quantitative means of pass/fail criterion should be defined.

-Limiting the load on the torso in the lateral direction. This is not a significant concern on forward- or aft-facing seats, but is on side-facing seats.

-Reducing the likelihood of pelvic fracture.

-Appropriate simulation of seat and restraint installation during the test.

In addition, the floor warpage conditions defined in § 25.562(b) are to be reviewed to define a suitable rationale for sofa fittings and structural deformation.

"5.- THE DEVELOPMENT OF THE SOFA

The current state-of-the-art is such that compliance substantiation is not a short term task. Several criteria may be abstracted from the automotive industry (Title 49 of the

code of Federal Rules) but other are to be defined. Suitable side-impact dummies have already been defined by the automotive industry and may be used for test purposes.

Taking into consideration the complexity of the problem and the high cost of the related dynamic testing, Dassault Aviation decided to start with an analytical evaluation of the sofa and the passenger behavior, using finite element models of the sofa and passengers, in a cooperative effort of the design office of a prime French car manufacturer, with its super computer allowed to select a test configuration.

The static test is anticipated in the coming weeks and a preliminary dynamic test is scheduled in July 1994 at the CEAT at Toulouse (France).

Following these tests, additional analysis will be necessary, but it is anticipated to provide sofa compliance with the structural requirements of § 25.562(b) in time for the type certification of the FALCON 2000 airplane scheduled for the end of November 1994.

Therefore, it is clear that sofas complying with suitable passenger protection criteria will need additional work. Contacts have been taken with the Civil Aeromedical Institute (CAMI) to organize tests in September - October 1994 to evaluate passenger protection pass/fail criteria and, according to the difference between the target criteria and the actual test results, analysis and new tests might be necessary until satisfactory results and complete development are attained.

"6.- THE PUBLIC INTEREST

The FALCON 2000 airplane is the first aircraft on which an overall dynamic evaluation of side-facing sofas plus the passenger restraint system is done, but there is still a considerable amount of work yet to be done.

At the time of the type certification the sofa will meet the static requirements of § 25.561 and the structural dynamic requirements set forth in § 25.562(b), as incorporated by Amendment 25-64 providing a level of protection of passengers higher than that provided prior to Amendment 25-64, i.e. that of the sofas of other business jets, during the interim period of the exemption.

"7.- THE EXEMPTION

A temporary exemption of two years is needed for passenger protection criteria set forth in § 25.562(c) so as to define suitable criteria in a joint effort with the specialists of the Transport Airplane Directorate and to publish them under the form of a Special Condition, and to produce sofas and passenger restraint systems complying with these criteria

During this period, sofas of different sizes for different number of passengers will be developed to accommodate the needs of customers, but they will comply with the same criteria.

"8.- MEETING COMPETITION

[The] Dassault Aviation FALCON 2000 aircraft is a direct competitor with other business jets such as the Gulfstream IV, and the Canadair Challenger, all of them having been designed prior to Amendment 25-64 and not submitted to the dynamic requirements applicable to the seats. Denial of Dassault Aviation's petition for a temporary exemption to § 25.562(c), as set forth in this letter, would place Dassault Aviation at a distinct disadvantage in the competitive general aviation market place for executive aircraft sales."

A summary of Dassault Aviation's petition was published in the Federal Register on September 13, 1994 (59 FR 47004). No comments were received.

The FAA's analysis/summary is as follows:

Amendment 25-64 of part 25 of the Federal Aviation Regulations (FAR) revised the emergency landing conditions that must be considered in the design of airplanes by revising the static loads, §25.561, for the entire airplane, and by introducing dynamic loads, § 25.562, for seating intended to be occupied for takeoff and landing. The intent of Amendment 25-64 is to provide equivalent protection for seated occupants, irrespective of whether the seats are forward-, side-, or aft-facing. However, since the preponderance of airplane seating is forward-facing, existing pass/fail criteria have focused primarily on these seats. Since the June 16, 1988, effective date of Amendment 25-64, several airplanes with forward- or aft-facing seats in their interior configurations have already been type certificated using the existing regulatory criteria, and one airplane with single-place, side-facing seats has been certificated using equivalent criteria defined in an Issue Paper. The Falcon 2000, on the other hand, is the first airplane with both multiple-place, side-facing seats (sofas) in its interior configurations and Amendment 25-64 in its certification basis, and represents the first instance in which it has been necessary to consider side-facing sofas with respect to the requirements of Amendment 25-64.

Accordingly, appropriate pass/fail criteria now need to be developed that fully address the concerns specific to occupants of side-facing sofas. The petitioner was encouraged in this regard, during the type certification process of the Falcon 2000, in Dassault Aviation Falcon 2000 Issue Paper CI-1 dated July 21, 1993, to develop and propose criteria which it felt would provide a level of protection equal to that afforded to

occupants of forward- and aft-facing seats. The FAA advised the petitioner that such a proposal must, as a minimum, address certain areas of concern that are repeated below:

1. **Contact between adjacent occupants**. One occupant must not be used to provide energy absorption for another occupant. If the seat or restraint design does not obviate contact, the consequences of head, torso, and upper and lower limb contact must be shown to be acceptable.

2. **Retention of the occupant in the seat and restraint system**. This concern must address the lower limbs as well as the torso. Failure to restrain the lower limbs may result in undesirable repositioning of the restraint system (e.g., the lap belt riding up to the soft stomach area, a shoulder harness pressing against the neck, or undesirable twisting of the lower lumbar spinal column). A quantitative means of assessing lower limb movement (leg flail) and a corresponding pass/fail criterion should be proposed.

3. **Limiting the load on the torso in the lateral direction**. The human torso has relatively low tolerance to loads in the lateral direction. This is not a significant concern on forward- or aft-facing seats, but it is on side-facing seats. A means of addressing this concern is the "Thoracic Trauma Index," (TTI) which is defined in Title 49, Part 572, Subpart F, of the Code of Federal Regulations (CFR). Tests to develop a TTI involve the use of a different anthropomorphic test dummy (ATD) than described in § 25.562. The ATD described in Title 49, CFR Part 572, Subpart F - Side Impact Dummy (SID) 50th Percentile Male, is appropriate. The FAA would accept a TTI of 85, which is a value acceptable to the National Highway Traffic Safety Administration (NHTSA).

4. **Reducing the likelihood of pelvic fracture**. The NHTSA has adopted a limit of 130 g's for acceptable pelvic acceleration as determined in tests using the SID ATD noted in item 3.

NOTE: The use of the SID ATD would be limited only to tests involving items noted in 3 and 4 above. The standard Hybrid II ATD should be used in any other dynamic testing (e.g., head injury criteria, seat structural strength, evaluation of restraint integrity, femur loads, and compressive load measured between the pelvis and the lumbar column).

5. **Appropriate simulation of seat and restraint installation during the tests**. In many installations, it is anticipated that the upper torso loads of the side-facing occupant will be reacted by wall structure adjacent to the occupant. The wall structure must be considered as part of the seat or restraint system, and therefore included in an appropriate manner as part of the test configuration. As a

minimum, the test must demonstrate that the wall will restrain the forward motion of the occupant.

6. **Consideration of all possible seating combinations**. All of the above must be shown to be acceptable for all possible combinations of seating which are allowed (e.g., a single occupant of the sofa in any seat position, or, assuming a three-place sofa, two occupants in any of the three possible seating combinations).

Notwithstanding the petitioner's comments relative to an intention to work with CAMI, this office is not aware of any activity that has been undertaken by the petitioner in seeking approval for proposals that address the above six concerns.

In reviewing the specifics of the petition itself, which is ambiguous in several respects, the FAA notes the following:

1. The petitioner is, without providing a justification for doing so, requesting a time-limited exemption from the entirety of § 25.562(c), which encompasses all existing seat strength and occupant protection pass/fail criteria. And yet, the petitioner expresses the intention to comply with seat strength criteria, and fails to present any arguments in support of exemption from any specific existing criteria. In response, the FAA has determined that the majority of existing criteria are equally applicable to forward-, aft-, and side-facing seats, and consequently shall be applicable. The only exception is § 25.562(c)(5), the head impact criterion (HIC), which is considered inappropriate for occupants of side-facing seats. A grant of exemption that is not time-limited is issued in this regard only, for side-facing seats only.

2. The FAA notes that although the petitioner requested exemption from all test criteria of § 25.562(c), no exemption was sought from the requirement of § 25.562(b) to perform those tests. This appears to be an inadvertent omission on the part of the petitioner, since testing without criteria would be counterproductive. This is a moot issue, however, because an exemption from only the HIC is granted.

3. No exemption was sought from § 25.562(a), which prescribes that seats and restraints be designed to protect occupants exposed to the indicated loads. The FAA does not consider that this required level of protection could be attained if only the testing that is interpreted to be proposed by the petitioner (i.e., seat strength) is accomplished successfully. Nor does the FAA consider that the intent of § 25.562(a) would be met for side-facing sofas and restraints even if they were successfully tested to all the existing criteria of § 25.562(c). Indeed, that determination prompted the Issue Paper noted above. Accordingly, until the petitioner has side-facing sofas and restraint designs that have been successfully tested to applicable existing criteria, as well as to acceptable new criteria to be developed by the petitioner from the FAA's concerns listed above, compliance with the requirements of § 25.562(a) is not possible.

With regard to the petitioner's comments concerning competition with existing airplanes certificated prior to Amendment 25-64, the FAA observes that the introduction of any new factor, including new safety requirements, into the marketplace can always be expected to be temporarily disturbing. It is unacceptable to seriously consider foregoing the introduction of new safety requirements because it may disturb the existing competitive balance. However, the FAA is not insensitive to this concern and, as demonstrated by this partial grant, is willing to allow a degree of phase-in for complying with especially difficult criteria. In any event, rather than viewing the imposition of this particular safety improvement as detrimental to its competitive position, as the petitioner apparently does, one could argue that manufacturers who offer airplanes featuring enhanced safety for its executive customers may likely enjoy a competitive advantage. Finally, the petitioner is advised that the FAA, in its effort to promote improved safety throughout the fleet, has taken the position of very strongly encouraging the incorporation of dynamically qualified seats into the scope of any significant modification to existing pre-Amendment 25-64 airplanes, including those manufactured by the petitioner's competitors.

The conditions associated with the following partial grant reflect the above considerations and discussions, and are established to allow a controlled and time-limited use of non-compliant side-facing sofas and restraints while an expedited schedule of research and testing is accomplished. Although this temporary exemption is granted at this time, there is an expectation that it may be extremely difficult, impractical, or impossible to develop acceptable and commercially desirable designs that can provide the same level of safety for occupants of side-facing sofas as for other seating. Accordingly, in order to preclude a protracted period of time during which fruitless research is being deliberately accomplished while occupants of side-facing sofas are not afforded equivalent safety, the FAA does not anticipate being predisposed to extend this grant unless success is imminent. The petitioner should expect the probability of needing to remove any side-facing sofas from service while the necessary research is completed.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest and will not significantly affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), to the extent necessary to permit type certification of the Falcon 2000 airplane equipped with side-facing sofas, Dassault Aviation is hereby granted the following:

1. A permanent exemption from the HIC requirements of § 25.562(c)(5) of the Federal Aviation Regulations (FAR); and

2. An exemption from the general requirements of § 25.562(a) of the FAR, until November 30, 1996, with the following conditions:

   a. Within six months of the issue date of this partial grant, the petitioner shall successfully conclude any incomplete qualification testing substantiating compliance with the occupant protection requirements of § 25.562(c)(1) through (4) and (6).

   b. Within six months from the issue date of this partial grant, the petitioner shall submit to this office, for FAA approval, a side-facing sofa developmental test proposal for addressing, as a minimum, the specific concerns identified in the noted Issue Paper and repeated herein.

   c. Within eighteen months of the issue date of this partial grant, the petitioner shall propose a production sofa design and installation description, and a detailed certification test plan and schedule for approval, that address the approved side-facing sofa criteria.

   d. Upon successful completion of certification testing, the petitioner shall provide this office with a schedule for assuring that the affected Falcon 2000 fleet will be retrofitted by November 30, 1996.

NOTE: Except as noted above, this partial grant of exemption expires November 30, 1996. Accordingly, the airworthiness certificates issued for any U.S.-registered airplanes equipped with side-facing sofas that have not been shown to comply with the conditions of this grant by that date will also expire on that date.

Issued in Renton, Washington, on November 29, 1994.

s/s Darrell M. Pederson, Acting Manager
Transport Airplane Directorate
Aircraft Certification Service, ANM-100